

A new species of *Oligoryzomys* (Rodentia, Sigmodontinae) from northeastern and central Brazil

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Abstract

A new *Oligoryzomys* species from Central and Northeastern regions of Brazil, *Oligoryzomys stramineus* sp. n., is described based on morphologic, biogeographic, and karyotypic analyses. A comparison with other *Oligoryzomys* species resulted in the distinction of two species groups: one comprising large-sized species with a white ventral surface (*O. chacoensis*, *O. nigripes*, *O. delticola*, and *O. stramineus* sp. n.) and another, comprising small-sized species with a yellow ventral surface (*O. fornesi*, *O. microtis*, and *O. flavescens*).

Key words: *Oligoryzomys stramineus*, new species, distribution, morphology, karyotype

Introduction

The genus *Oligoryzomys* Bangs, 1900 is distributed throughout a large portion of the Neotropical region (CARLETON and MUSSER 1989) and includes species considered to be important components of small mammalian communities in South America (ALHO and PEREIRA 1985; MARES et al. 1981, 1989; MARES and ERNEST 1995). However, the taxonomy of this genus is controversial, leading to different taxonomic arrangements that include disparate numbers of species, ranging from 1 (HERSHKOVITZ 1966) to 30 (TATE 1932). Thus, despite extensive studies on *Oligoryzomys* taxonomy (LANGGUTH 1963; MYERS and CARLETON 1981; OLDS and ANDERSON 1987; CARLETON and MUSSER 1989; DICKERMAN and YATES 1995) and cytogenetics (GARDNER and PATTON 1976; YONENAGA et al. 1976; MYERS and CARLETON 1981; FURTADO 1981; SVARTMAN 1989; SBALQUEIRO et al. 1991; ESPINOSA and REIG 1991), this genus is still poorly understood.

MYERS and CARLETON (1981) and OLDS and ANDERSON (1987) suggested that *Oligoryzomys* comprised two species groups: one, of large-body-sized species, including *O. chacoensis* (Myers and Carleton, 1981), *O. eliurus* (Wagner, 1845), *O. longicaudatus* (Bennett, 1832), *O. nigripes* (Olfers, 1818), and another, of small-body-sized species, including *O. delicatus* (Allen and Chapman, 1897), *O. flavescens* (Waterhouse, 1837), *O. fornesi* (Massoia, 1973), and *O. microtis* (Allen, 1916).

In this study, we describe a new *Oligoryzomys* species belonging to the large-body-sized group. This species has been morphologically and karyotypically characterized and compared to other *Oligoryzomys* species, especially to those with sympatric and parapatric distributions.

Material and methods

Morphological studies were carried out in 292 specimens of *Oligoryzomys* deposited on the mammals collections of: United States Natural Museum (USNM, Washington, 125 specimens); University of Michigan-Museum of Zoology (UMMZ, Ann Arbor, 12 specimens); Universidade Federal da Paraíba (UFPB, João Pessoa, 65 specimens); Universidade de Brasília (UnB, Brasília, 23 specimens); Museu Nacional do Rio de Janeiro (MN, Rio de Janeiro, 37 specimens); Laboratório de Vertebrados (LV, Universidade Federal do Rio de Janeiro, Rio de Janeiro, 23 specimens). PH (7 specimens) refers to field numbers of P. HERSHKOVITZ and this material will be housed in Museu Nacional do Rio de Janeiro and Field Museum of Natural History (FMNH, Chicago).

The following specimens of *Oligoryzomys* were examined:

O. stramineus sp. n. (45 specimens): BRAZIL: Paraíba State, Pirauá, Natuba (UFPB-AL 2049, 2057, UFPB-LFS 49); Pernambuco State, Angelim (UFPB-G 62) Bom Conselho (UFPB-PMN 360, 497, 561, -G 106) Correntes (UFPB 1863, -PMN 280) Exú (USNM 528416) Macaparana (UFPB-AL 2020); Goiás State, Terezina de Goiás (MN 34439, 46406–35; Minas Gerais State, Montes Claros (LV-FC 10, 21).

O. nigripes (85 specimens): ARGENTINA: Delta del Rio Paraná (MN 24598–99, 245579); BRAZIL: Federal District, Brasília (UnB 295–96, 298–305, 912–13, 962, 999); Espírito Santo State, 24 km SE of Venda Nova (UFPB 1813); Goiás State, 30 km E of Flores de Goiás (UFPB 1826, 1828–30, 1832, 1834, 1836–44, 1846–55, 1871, AL 2982); Minas Gerais State, Montes Claros (LV-FC 51) Peirópolis (LV-MW 14) Parque Nacional do Caparaó (PH 10076, 10084, 10107, 10274) Serra do Caparaó (MN 33214, 33218); Paraíba State, Pirauá (UFPB-LFS 49); Pernambuco State, Bom Conselho (UFPB PMN 563) Buique (UFPB 1872); Rio de Janeiro State, Sumidouro (LV-SU 210, 219, 221, 228, 232, 234, CRB 800–03) São Paulo State, Casa Grande (UFPB 1162) Iguape (UFPB 1150, 1152) Taubaté (UFPB 1164). PARAGUAY: Paraguari Department, Sapucaí (USNM 121107, 121403–07, 124555–56, 172970) Tacuatí 3 km SE of Aca Poi (USNM 293146); Caaguazú Department, Caaguazú (USNM 293144–45); Misiones Department, San Pablo, 20 km of San Ignacio (USNM 390106) San Francisco, 36 km NE San Ignacio (USNM 390107–08).

O. delicola (8 specimens): BRAZIL: Rio Grande do Sul (UFPB 600, 613, 615–17); ARGENTINA: Chacos, Las Palmas (USNM 236285–87).

O. chacoensis (9 specimens): ARGENTINA: Formosa (USNM 236243, 236288–92); BOLIVIA: Entre Rios (USNM 271411–12, 271432).

O. flavescens (57 specimens): ARGENTINA: 25 km SE of Buenos Aires (USNM 331059) General Lavalle (USNM 236274) Concepcion (USNM 259280, 299285, 259290). BRAZIL: Bahia State, Rio Una, 10 km E/SE of São José (UFPB 429); Minas Gerais State, Parque Nacional de Caparaó (PH 10129, 10139, 10422) Viçosa (USNM 541498, LV-LG 71, 72), Rio Grande do Sul State (UFPB 601); São Paulo State, Casa Grande (USNM 461991, 484122–25) Itapetininga (USNM 460516–17, 461049–55, 461990, 461992–94, 484126–33, 484136–37, 405056, 542968–69). PARAGUAY: Caaguazú Department, 24 km NNW Carayaó (UMMZ 133816–17); Canendeyu Department, Curuguaty (UMMZ 124216–17, 124222, 124255) Misiones Department, San Pablo, 20 km W San Ignacio (USNM 390122) Pres. Hayes Department, 24 km NW Villa Hayes (UMMZ 133833, 133841–42). URUGUAY: Maldonado (USNM 259599), Montevideo (USNM 174937) Boca del Arroyo del Tigre, San José (UFPB-AL 922).

O. fornesi (31 specimens): BRAZIL: Federal District, Brasília (UnB 279, 288–91, 965, 294, 931, 1212); Goiás State, Corumbá de Goiás (MN 34440) Terezina de Goiás (LV-CRB 674, 708, 709, 733, 747, 757, 768); Paraíba State, Mamanguape (UFPB-MPS 72); Pernambuco State, Buíque (UFPB 1893–94) Bom Conselho (UFPB-PMN 60, 61, 63, 576) Correntes (UFPB 1893–94) Macaparana (UFPB-MPS 34); Sergipe State, 6 km SSL of Matriz de Camaragipe (UFPB 977). PARAGUAY: Caaguazú Department, 24 km NE Carayaó (UMMZ 133818–19) Canendeyu Department, Curuguaty (UMMZ 124218).

O. microtis (57 specimens): BOLIVIA: Beni, Boroica (USNM 460740) Chachuelita (USNM 460739) Chaco Lejo (USNM 391295–97) El Triunfo (USNM 391298) Las Penas (USNM 460741) San Joaquin (USNM 364735, 364738, 364742, 364921, 364923, 391299, 460273, 460742–43) Totai (USNM 364948). BRAZIL: Amazonas State, Terruan, Rio Purus (USNM 461396, 461398–99); Pará State, Belém (USNM 461069–72, 461076, 545290–92) Marabá, Serra do Norte (USNM 543345–46) 75 km N 45 km W Marabá, near Jatobal (USNM 519769, 519771, 521454–62, 521540). PERU: Madre de Dios, Puerto Maldonado (USNM 390112, 390115–19) Rio Manu, 57 km above mouth (USNM 559399–403) Tambopata, 30 km above mouth (USNM 30925) Ucayali, 59 km SW Pucallpa (USNM 499223–25).

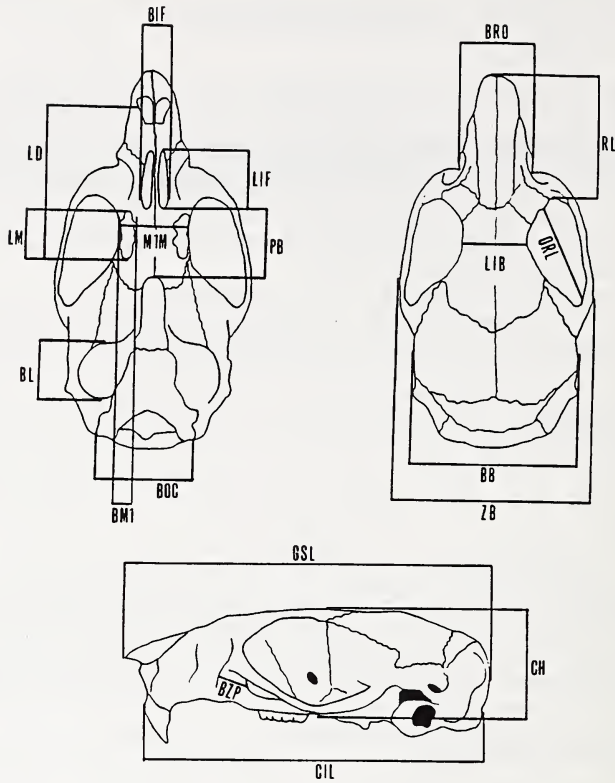


Fig. 1. Ventral, dorsal and lateral view of *Oligoryzomys* skull showing the measurements. The variables abbreviations are in material and methods.

In addition to morphological studies, we karyotyped 62 *Oligoryzomys* specimens: 8 *Oligoryzomys fornesi*, 7 specimens from Terezina de Goiás and 1 from Corumbá de Goiás (Goiás State, Brazil); 5 *O. flavescens*, 3 specimens from Parque Nacional do Caparaó and 2 from Viçosa (Minas Gerais State); 16 *O. nigripes*, 10 specimens from Sumidouro (Rio de Janeiro State), 4 from Parque Nacional de Caparaó, 1 from Peirópolis and 1 from Montes Claros (Minas Gerais State); 33 *O. stramineus* sp.n., 31 specimens from Terezina de Goiás and 2 from Montes Claros. Chromosome preparations followed the procedure of FORD and HAMERTON (1956). The skins and skulls of these specimens were deposited in FMNH, LV, and MN collections.

For morphometric comparisons, we took 19 measurements from skulls: Greatest Skull Length (GSL), Condilo-Incise Length (CIL), Breadth of the Occipital Condyles (BOC), Length of Diastema (LD), Palatal Bridge (PB), Length of Incisive Foramen (LIF), Breadth of Incisive Foramen (BIF), Length of Maxillary Molars (LM), Breadth of First Maxillary Molar (BM1), External Alveolar Breadth (M1M), Bullae Length (BL), Cranial Height (CH), Rostrum Length (RL), Rostrum Breadth (BRO), Least Interorbital Breadth (LIB), Orbital Length (ORL), Zygomatic Breadth (ZB), Breadth of Braincase (BB), and Breadth of the Zygomatic plate (BZP) (Fig. 1). The definitions of these measurements were the same as in VOSS (1988) and HERSHKOVITZ (1991). M1M is the distance between the labial side of first upper molars; BRO is the greatest breadth of the rostrum, and ORL is the greatest internal diagonal distance of the orbit (Fig. 1). Cranial and dental measurements were taken with digital callipers and are summarized in table 1.

For morphometric analysis, we exclusively considered adult animals (with all teeth erupted and functional). The following statistics were used: Analysis of Variance with LSD test for contrasting means, Canonical Discriminant Analysis, and Principal Components Analysis using pooled within-group covariance matrix of logarithmic variables.

Table 1. Sample size, mean, standard deviation, and range of cranial variables. See methods to variables abbreviation. n = total sample size.

	<i>O. stramineus</i> sp. n. n=36	<i>O. chacoensis</i> n=5	<i>O. delticola</i> n=8	<i>O. nigripes</i> n=35	<i>O. fornesi</i> n=26	<i>O. flavescens</i> n=41	<i>O. microtis</i> n=46
GSL	33 25.7±1.1 (23.3-28.3)	3 23.8±0.6 (23.2-24.3)	7 25.0±1.3 (23.2-26.3)	31 25.5±1.3 (23.1-28.4)	25 22.8±0.8 (21.0-24.0)	38 22.5±1.1 (20.1-24.3)	35 23.5±1.1 (21.1-26.0)
CIL	34 23.2±1.1 (20.4-25.8)	3 21.2±0.7 (20.6-21.9)	7 22.6±1.3 (20.7-24.0)	31 22.9±1.3 (20.7-25.9)	25 20.3±0.8 (18.7-21.6)	41 20.0±1.0 (17.4-22.0)	40 20.8±1.4 (17.6-23.8)
BOC	33 5.7±0.2 (5.4-6.1)	3 5.7±0.3 (5.5-6.0)	7 5.9±0.3 (5.5±6.3)	33 5.7±0.2 (5.3-6.5)	25 5.4±0.2 (5.1-5.9)	41 5.4±0.2 (5.2-5.8)	36 5.6±0.2 (5.0-6.2)
LD	36 6.4±0.4 (5.3-7.5)	5 5.7±0.5 (5.2-6.3)	8 6.2±0.4 (5.6-6.7)	35 6.3±0.4 (5.4-7.6)	26 5.6±0.3 (5.0-6.2)	39 5.4±0.4 (4.5-6.0)	45 5.7±0.5 (4.4-6.5)
PB	36 4.7±0.3 (4.2-5.4)	5 4.1±0.2 (3.8-4.2)	8 4.4±0.4 (3.8-4.8)	34 4.5±0.3 (3.9-5.2)	26 4.0±0.2 (3.6-4.5)	41 3.8±0.2 (3.1-4.2)	44 4.2±0.3 (3.3-4.9)
LM	36 3.7±0.2 (3.3-4.2)	5 3.5±0.1 (3.3-3.7)	8 3.4±0.2 (3.2-4.0)	35 3.7±0.1 (3.5-4.0)	26 3.1±0.2 (2.8-3.6)	41 3.2±0.1 (3.0-3.5)	45 3.1±0.1 (2.7-3.5)
LIF	36 4.9±0.4 (4.2-5.7)	5 4.1±0.3 (3.9-4.5)	8 4.6±0.3 (4.1-5.3)	35 4.8±0.3 (4.1-5.9)	26 3.9±0.3 (3.4-4.9)	41 4.3±0.3 (3.4-4.9)	46 3.7±0.3 (3.2-4.6)
BIF	36 1.8±0.2 (1.5-2.4)	5 1.6±0.1 (1.4-1.8)	8 1.7±0.1 (1.6-1.9)	35 1.8±0.1 (1.5-2.1)	26 1.7±0.1 (1.4-1.9)	41 1.5±0.1 (1.3-1.8)	46 1.6±0.2 (1.3-2.0)
M1M	35 4.7±0.2 (4.3-5.3)	5 4.5±0.1 (4.5-4.6)	8 4.6±0.2 (4.3-5.0)	35 4.6±0.2 (4.3-5.1)	25 4.2±0.2 (3.9-4.6)	41 4.2±0.2 (3.8-4.5)	46 4.3±0.2 (3.8-4.9)
BM1	36 1.1±0.1 (1.0-1.3)	5 1.1±0.1 (1.1-1.2)	8 1.1±0.1 (1.0-1.2)	35 1.1±0.1 (1.0-1.2)	26 0.9±0.1 (0.8-1.1)	41 1.0±0.1 (0.9-1.1)	45 1.0±0.1 (0.8-1.2)
BL	35 3.5±0.3 (2.8-4.1)	3 3.5±0.1 (3.3-3.6)	8 3.4±0.2 (3.1-3.8)	31 3.5±0.2 (3.1-3.9)	25 3.1±0.3 (2.5-3.8)	41 3.1±0.2 (2.9-3.6)	42 3.0±0.2 (2.5-3.4)
CH	36 7.8±0.3 (7.3-8.4)	5 7.5±0.2 (7.2-7.8)	8 7.6±0.4 (7.1-8.1)	35 7.8±0.3 (7.3-8.8)	25 7.0±0.3 (6.5-7.5)	41 7.1±0.3 (6.5-8.0)	46 7.1±0.3 (6.3-8.4)
RL	35 9.3±0.6 (7.8-10.7)	4 8.7±0.6 (8.3-9.5)	8 8.9±0.5 (7.9-9.6)	35 9.1±0.7 (7.7-10.6)	26 7.9±0.4 (7.3-8.7)	38 7.6±0.5 (6.4-8.6)	42 8.1±0.6 (6.3-9.1)
BRO	35 4.7±0.3 (4.2-5.6)	5 4.5±0.3 (4.2-4.8)	8 4.4±0.2 (4.1-4.7)	35 4.6±0.3 (4.0-5.4)	26 4.1±0.2 (3.7-4.7)	40 4.1±0.3 (3.5-4.5)	46 4.3±0.3 (3.4-5.0)
LIB	36 3.8±0.1 (3.5-4.0)	5 3.9±0.1 (3.8-4.0)	8 3.6±0.2 (3.4-3.8)	35 3.8±0.2 (3.5-4.1)	25 3.7±0.2 (3.3-4.2)	41 3.4±0.2 (3.2-3.9)	46 3.8±0.2 (3.4-4.1)
ORL	36 8.8±0.4 (7.6-9.6)	5 8.3±0.2 (8.0-8.5)	8 8.4±0.5 (7.7-8.8)	35 8.7±0.3 (8.1-9.5)	26 7.7±0.4 (6.8-8.6)	41 7.6±0.4 (6.6-8.2)	46 8.0±0.5 (6.5±8.9)
ZB	36 13.2±0.6 (11.9-14.8)	4 12.8±0.3 (12.3-13.1)	8 13.0±0.6 (12.2-14.0)	35 13.3±0.6 (12.3-14.9)	26 12.0±0.6 (10.5-12.8)	37 12.0±0.7 (10.3-13.3)	44 12.1±0.7 (10.2-13.5)
BB	35 10.7±0.4 (10.1-11.6)	3 10.6±0.1 (10.4-10.6)	7 10.6±0.3 (10.1-11.1)	32 10.9±0.3 (10.2-11.5)	24 10.0±0.4 (9.1-10.7)	41 10.1±0.3 (9.5-11.0)	45 10.2±0.4 (9.4-11.6)
BZP	36 2.8±0.2 (2.3-3.5)	5 2.4±0.3 (1.9-2.7)	8 2.6±0.2 (2.4-2.9)	34 2.6±0.2 (2.1-3.0)	26 2.3±0.1 (2.0-2.5)	40 2.2±0.2 (1.8-2.6)	46 2.2±0.1 (1.8-2.4)

Results

Karyotypic analysis of 16 *Oligoryzomys nigripes* showed $2n = 62$ /FN = 81–82. This variation in fundamental number was due to a polymorphism resulting from an inversion in one member of pair no. 3. Five *O. flavescens* showed $2n = 64$ /FN = 68 while 8 *O. fornesi* showed $2n = 62$ /FN = 64.

Karyotypic analysis of 30 *O. stramineus* sp.n. showed $2n = 52$ /FN = 68 (Fig. 2). The autosomal complement is composed of 9 pairs of biarmed chromosomes (2 large pairs of metacentrics, 5 medium-sized pairs of metacentrics, and 2 small pairs of metacentrics) and 16 pairs of acrocentrics (1 large pair and other 15 pairs varying gradually in size from medium to small). The X chromosome is a large-sized submetacentric, and the Y chromo-



Fig. 2. *Oligoryzomys stramineus* sp. n. karyotype.

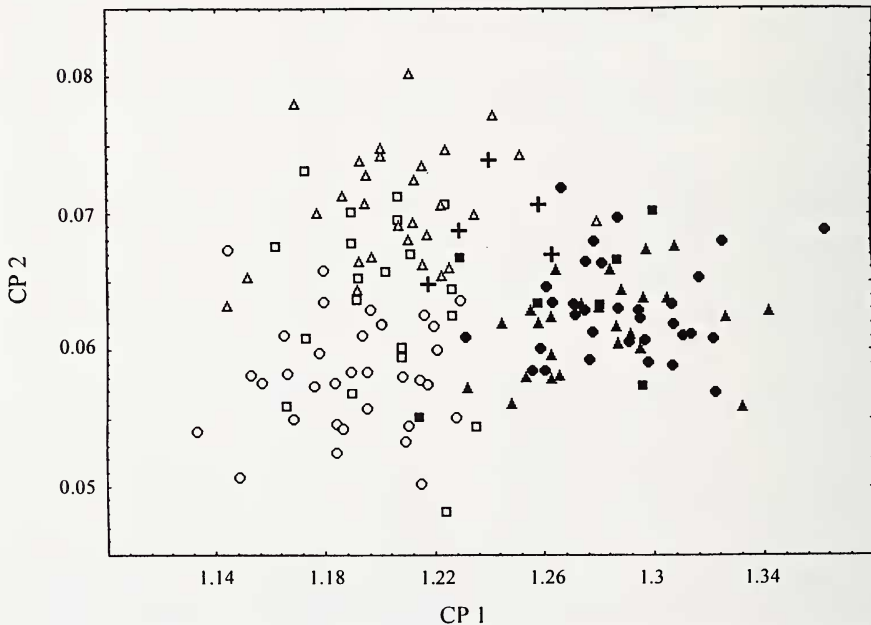


Fig. 3. Scores of the first two principal components (CP) extracted from the pooled within-group covariance matrix of log transformed measurement data: ● *Oligoryzomys stramineus* sp. n., ■ *O. delticola*, ▲ *O. nigripes*, + *O. chacoensis*, △ *O. microtis*, □ *O. fornesi*, and ○ *O. flavescens*. The eigenvalues of the first two principal components are 0.102 (CP1) and 0.010 (CP2), corresponding to 70.6% and 7.1% of total variance.

some a medium-sized metacentric. Three specimens of *O. stramineus* sp. n. from Terezina de Goiás showed $2n = 52/FN = 69$ due to a pericentric inversion in one chromosome of a small acrocentric pair.

In morphometric analysis, we grouped together males and females of all species because in *O. stramineus* sp. n., no significant sexual dimorphism was detected (t test). Principal Components Analysis (Fig. 3) grouped *O. nigripes*, *O. delticola* (Thomas, 1917), *O. chacoensis*, and *O. stramineus* sp. n. apart from *O. fornesi*, *O. microtis*, and *O. flavescens*. This separation occurred in the plane of the first principal component. Among species of the first group, *O. chacoensis* was closest to those of the second group. As the Principal Components Analysis separated two well delimited groups, one composed by small-sized species with yellow belly and another, of large-sized species with a white belly including *O. stramineus* sp. n., further analyses were carried out in this latter group.

Within the large-sized group, Canonical Discriminant Analysis discriminated three groups, (1) *O. nigripes* and *O. delticola*, (2) *O. chacoensis*, and (3) *O. stramineus* sp. n. (Fig. 4). Analysis of Variance between *O. nigripes*, *O. delticola*, *O. chacoensis*, and *O. stramineus* sp. n. showed significant differences in 10 cranial characters (GSL: $F = 2.99$, $p = 0.04$; CIL: $F = 3.62$, $p = 0.02$; LD: $F = 3.45$, $p = 0.02$; BP: $F = 3.99$, $p = 0.01$; LM: $F = 5.09$, $p = 0.004$; LIF: $F = 7.83$, $p = .0002$; BIF: $F = 2.94$, $p = 0.04$; LIB: $F = 4.58$, $p = 0.007$; ORL: $F = 2.82$, $p = 0.05$; BZP: $F = 3.27$, $p = 0.03$). LSD test ($p < 0.05$) showed that *O. stramineus* sp. n. was significantly different from: *O. chacoensis* in 9 variables (GSL, CIL, LD, BP, LM, LIF, BIF, ORL, BZP), *O. delticola* in 2 variables (LIB, ORL), and *O. nigripes* in 2 variables (LIB, BZP). This analysis also showed that *O. delticola* differed from *O. nigripes* in 2 variables (LIB, ORL) and from *O. chacoensis* in 2 variables (LM, LIB). Finally, *O. chacoensis* differed from *O. nigripes* in 8 variables (GSL, CIL, LD, BP, LM, LIF, BIF, ORL).

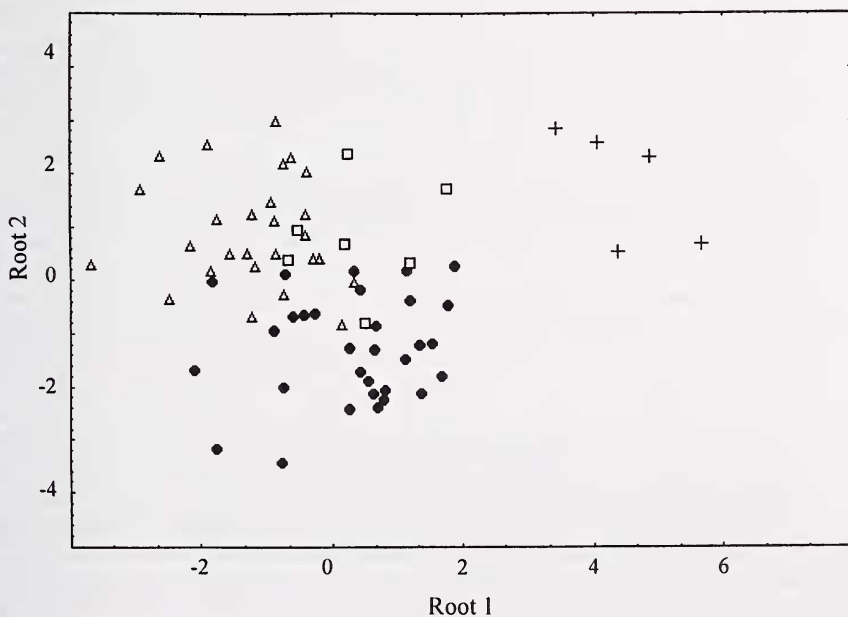


Fig. 4. Plot of the first two Canonical Discriminant Functions: Symbols are ● *Oligoryzomys stramineus* sp. n., □ *O. delticola*, △ *O. nigripes*, + *O. chacoensis*. The eigenvalues of the canonical functions are 2.12 (CF1) and 1.41 (CF2).

Discussion

Karyological considerations

The $2n = 62/FN = 81-82$ karyotype herewith reported in *O. nigripes* is similar to the one found in specimens captured near its type locality in Paraguay by MYERS and CARLETON (1981) who considered this karyotype as characteristic of this species. A similar karyotype, however, was also found in animals captured in the type locality of *O. delticola* (ESPINOZA and REIG 1991), indicating that *O. delticola* and *O. nigripes* are karyotypically similar. Furthermore, specimens from São Paulo State (YONENAGA et al. 1976), captured near the type locality of *O. elurus*, were also karyotypically similar to *O. delticola* and *O. nigripes*. In this latter species, chromosome polymorphisms were reported ($2n = 62/FN = 79$ to 82) due to pericentric inversions in pairs nos. 3, 4 and/or 8 (YONENAGA et al. 1976; ALMEIDA and YONENAGA-YASSUDA 1991). These findings are coincident with ours in showing pericentric inversions in pair no. 3 of *O. nigripes*. Comparative karyological data indicate that all the above mentioned species comprise a karyomonomorphic group clearly apart from *O. stramineus* sp. n. ($2n = 52/FN = 68$).

The 33 specimens of *O. stramineus* sp. n. here karyotyped showed $2n = 52/FN = 68-69$ similar to specimens from Paraíba and Pernambuco states karyotyped by FURTADO (1981). Moreover, a single specimen (USMN 528416) from Exú, Pernambuco State, considered to be *O. chacoensis* by CARLETON and MUSSEY (1989), showed $2n = 52/FN = 70$ (GARDNER, pers. comm.); this difference in fundamental number being apparently due to an inversion in a small acrocentric pair. On the other hand, all 16 specimens of *O. chacoensis* studied by MYERS and CARLETON (1981) showed $2n = 58/FN = 74$. Karyological comparisons between *O. stramineus* sp. n. and *O. chacoensis* showed differences in diploid and fundamental number and in the size of biarmed and acrocentric chromosomes. *O. stramineus* sp. n. has 2 pairs of large metacentric chromosomes approximately twice as large as any other of the 7 pairs of biarmed chromosomes while *O. chacoensis* has only 1 large pair of metacentric chromosomes approximately twice as large as any other of the 8 pairs of biarmed chromosomes. Additionally, the number of acrocentric chromosomes differs between species; corresponding to 16 pairs in *O. stramineus* sp. n. and to 19 pairs in *O. chacoensis*. These differences confirmed that *O. chacoensis* and *O. stramineus* sp. n. are karyologically different, as to be expected in different species.

In *O. longicaudatus*, GALLARDO and PATTERSON (1985) found $2n = 56/FN = 66$ and $2n = 54/FN = 66$. These karyotypic differences were explained by a fusion event involving two acrocentric chromosomes of $2n = 56$ producing a large biarmed chromosome in $2n = 54$. Karyological comparisons between *O. stramineus* sp. n. and $2n = 54$ *O. longicaudatus* showed clear differences in diploid and fundamental number as well as in chromosome morphology. *O. stramineus* sp. n. has 2 additional biarmed chromosome pairs (one large-sized and another small-sized), and a large-sized acrocentric pair without recognizable counterparts in *O. longicaudatus*.

The *O. flavescens* karyotype ($2n = 64-66/FN = 66-68$) was described by SBALQUEIRO et al. (1991); variations in diploid number being due to presence of up to 2 B-chromosomes that, in specimens with $2n = 65$, behaved as univalents in first meiotic divisions. Similar variations were found in *O. flavescens* captured at its type locality (BRUM-ZORRILA et al. 1988) as well as in São Paulo State (YONENAGA et al. 1976; KASAHARA 1978). Karyological comparisons (SBALQUEIRO et al. 1991) indicated that this karyotype was indistinguishable from the one found in specimens captured in Paraguay ($2n = 64-66$) which had been identified as *O. fornesi* by MYERS and CARLETON (1991). The *O. flavescens* here studied showed $2n = 64/FN = 68$ instead of $2n = 64/FN = 66$ as previously reported (SBALQUEIRO et al. 1991). This difference in fundamental number can be explained by an inversion resulting in one small metacentric pair.

O. fornesi showed $2n = 62/FN = 64$. Comparative karyological data indicate that *O. fornesi* and *O. flavescens* are clearly different from *O. stramineus* sp. n. ($2n = 52/FN = 68$).

Morphological considerations

Morphological and morphometric analyses showed that *O. stramineus* sp. n. differed from other species herewithin studied. *O. stramineus* sp. n. belongs to the large-sized group, being more similar in size to *O. nigripes* and *O. delticola*. *O. stramineus* sp. n. differs from *O. nigripes*, *O. delticola*, and *O. eliurus* by the following characters: (1) larger zygomatic plate resulting in a deeper zygomatic notch, (2) broader external wall of groove of infraorbital branch of the stapedia artery in the parapterygoid plate, (3) incisive foramen reaching or extending across plane delimited by first molars at all ages, contrary to the other 3 species in which this only occurs in young animals, (4) paler overall pelage color. It differs from *O. chacoensis* by the following characters: (1) larger body size, (2) more pronounced angular fossa, and (3) karyotype. It also differs from *O. longicaudatus* by its karyotype. Comparisons with other *Oligoryzomys* species were less important because their distributional limits are distant from the geographic distribution of *O. stramineus* sp. n.

O. stramineus sp. n. differs from *O. fornesi*, *O. microtis*, and *O. flavescens* by the following characters: (1) larger size, (2) whitish ventral color, (3) sharper contrast between ventral and lateral body parts, (4) shorter incisive foramen (only in respect to *O. flavescens*), and (5) karyotype.

O. fornesi was considered a junior synonym of *O. microtis* by OLDS and ANDERSON (1987) and CARLETON and MUSSER (1989). However, we consider *O. microtis* and *O. fornesi* as valid species on the basis of: (1) Principal Components Analysis, separating *O. microtis* from *O. fornesi* in the plane of CP2; (2) use of different habitat, because *O. fornesi* is predominantly distributed in open vegetational formations and *O. microtis* mainly occupies areas of forest formations; (3) molecular data, showing *O. fornesi* and *O. microtis* within separate clades (MYERS et al. 1995).

We found morphological differences between specimens with $2n = 62$ (*O. fornesi*) and $2n = 64-66$ (*O. flavescens*), like a smaller incisive foramen (not reaching plane of first molar) in the former, and a larger one (reaching the plane of first molar) in the latter. These findings were confirmed in several specimens examined by us and previously karyotyped by MYERS and CARLETON (1981); (USNM 124218, 133818, 133819 with $2n = 62/FN = 64$, and USNM 124216, 124217, 124222, 124255, 133816, 133833, 134341, 134342 with $2n = 64-66/FN = 66-68$). MYERS and CARLETON (1981), however, identified these specimens as *O. fornesi*. This identification is questionable in view of more recent reports and our karyological data showing that specimens with $2n = 64-66/FN = 66-68$ belong to *O. flavescens* and those with $2n = 62/FN = 64$ to *O. fornesi*. This karyologic difference is further supported by our morphological analysis.

Geographic considerations

In view of our findings, the distribution of *O. nigripes* is considerably larger than previously estimated by MUSSER and CARLETON (1993). It extends through Northern Argentina, Paraguay and part of Brazil (in the Atlantic forest from Rio Grande do Sul State to Bahia State, in central Brazil in the Distrito Federal and Goiás State, and in Northeastern Brazil in Pernambuco and Paraíba states).

O. chacoensis was first considered to be distributed in Bolívia (Depto. Beni, Santa Cruz and Tarija), Argentina (Formosa) and southwestern Brazil (Mato Grosso State; MYERS and CARLETON 1981) and its distribution was later extended to Jujuy, Chaco and

Salta in Argentina, and Ceará and Pernambuco states in Brazil (CARLETON and MUSSER 1989). It is, however, unlikely that this distribution extends to Pernambuco State because the single specimen (USNM 528416) studied by CARLETON and MUSSER (1989) actually belongs to *O. stramineus* sp. n. (see comments in the description of the species).

MYERS and CARLETON (1981) extended the geographic distribution of *O. fornesi* to São Paulo State on the basis of karyotypic data reported by YONENAGA et al. (1976). However, this is dubious in view that this karyotype ($2n = 64-66$, $FN = 66-68$) is characteristic of *O. flavescens*. Later reports (OLDS and ANDERSON 1987; CARLETON and MUSSER 1989) considered *O. microtis* and *O. fornesi* as synonymous, thus extending the geographic distribution of *O. microtis* to Goiás State and Distrito Federal, Brazil. However, molecular and morphological evidence indicate *O. microtis* and *O. fornesi* as valid species, thus invalidating the extended distribution of *O. microtis* (specimens from Goiás State, Terezina de Goiás and Corumbá de Goiás, and Distrito Federal, Brasília showed morphological and karyological characteristics of *O. fornesi*).

O. stramineus sp. n. occurs in the Cerrado (Goiás and Minas Gerais states) and Caatinga (Paraíba and Pernambuco states), being sympatric with *O. nigripes* in Pirauá (Paraíba State), Bom Conselho (Pernambuco State), and Montes Claros (Minas Gerais State), and with *O. fornesi* in Terezina de Goiás (Goiás State), Bom Conselho, Correntes, and Macapara (Pernambuco State) and Montes Claros (Minas Gerais State).

Oligoryzomys species are frequently sympatric, with the occurrence of large-sized and small-sized species in the same locality (THOMAS 1926; LANGGUTH 1963; MYERS and CARLETON 1981; SVARTMAN 1989). In the Cerrado of Central Brazil (Terezina de Goiás), we collected *O. fornesi* and *O. stramineus* sp. n. in the same habitat and trapline. In the Parque Nacional de Caparaó, we also collected *O. flavescens* and *O. nigripes* in the same habitat and trapline. In a transitional region between Caatinga and Cerrado in Minas Gerais State (Montes Claros), we collected *O. fornesi*, *O. nigripes*, and *O. stramineus* sp. n., though the latter two were not captured in the same habitat and trapline. Apparently, the forest formations of the Brazilian Atlantic forest contain, at least, two allopatric large-sized species with white belly, *O. nigripes* and *O. delticola*, and one small-sized species with yellow belly, *O. flavescens*, that is sympatric with either of the former. *O. nigripes* and *O. flavescens*, on the other hand, occur in the Cerrado of Central Brazil, but they have been collected in gallery forest, a link to the Atlantic forest. *O. nigripes*, moreover, also occurs in less dry areas of the Brazilian Caatinga. Two other species only occur in open vegetation formations (Cerrado and Caatinga): the large-sized white-bellied *O. stramineus* sp. n., and the small-sized yellow-bellied *O. fornesi*. *O. microtis* is distributed in the Amazonian forest. *O. chacoensis* occupies open vegetation formations from western Paraguay, SE Bolívia, Argentina, extending to Mato Grosso State, in Brazil (MYERS and CARLETON 1981).

On the basis of morphologic studies, karyologic data, and geographic distribution, *O. stramineus* sp. n. is herein described as a new species.

***Oligoryzomys stramineus* new species**

Holotype: MN 34439, skin and skull of adult male collected by S. M. LINDBERGH in 1991, field number CRB 607 (Figs. 5 and 6).

Other specimens examined: MN 46406, 46407, 46408, 46409, 46410, 46412, 46413, 46414, 46415, 46416, 46417, 46418, 46419, 46420, 46421, 46422, 46423, 46424, 46426, 46427, 46430, 46431, 46432, 46433, 46434 Terezina de Goiás, Goiás State, Brazil), LV-FC 10, 21 (Montes Claros, Minas Gerais State), UFPB-AL 2020 (Sítio José Camilo, Natuba, Paraíba State, Brazil), UFPB-LFS 49 (Pirauá, Paraíba State, Brazil), UFPB-AL 2049 (Vila Pirauá, Natuba, Paraíba State, Brazil), UFPB 1863 (Sítio Pau Vermelho, Correntes, Pernambuco State, Brazil), UFPB-PMN 360, 497 (Bom Conselho, Pernambuco State, Brazil), USNM 528416 (Exú, Pernambuco State, Brazil). All these specimens were karyotyped.

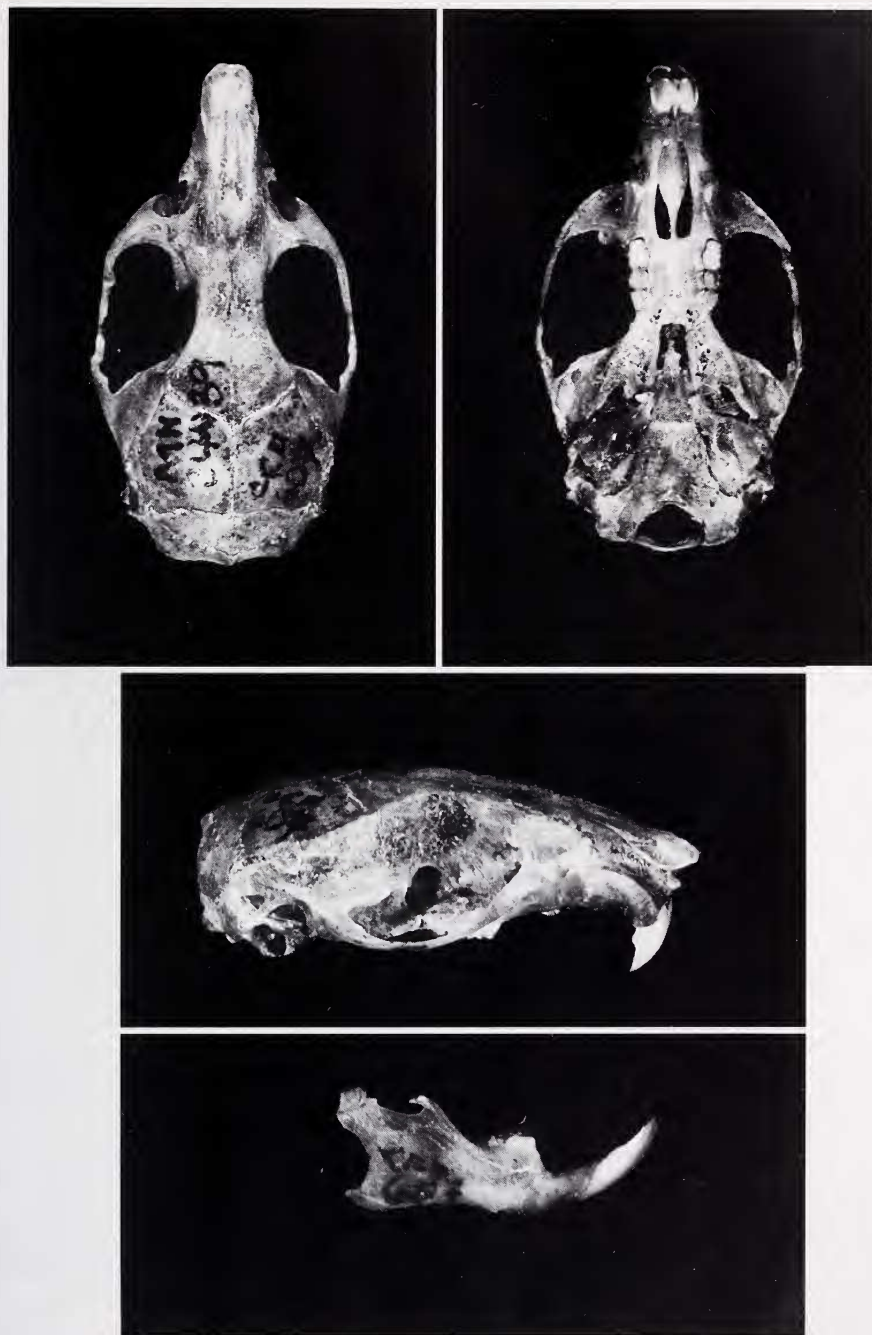


Fig. 5. Dorsal, ventral and lateral view of skull of *Oligoryzomys stramineus* sp. n. holotype (MN34439).

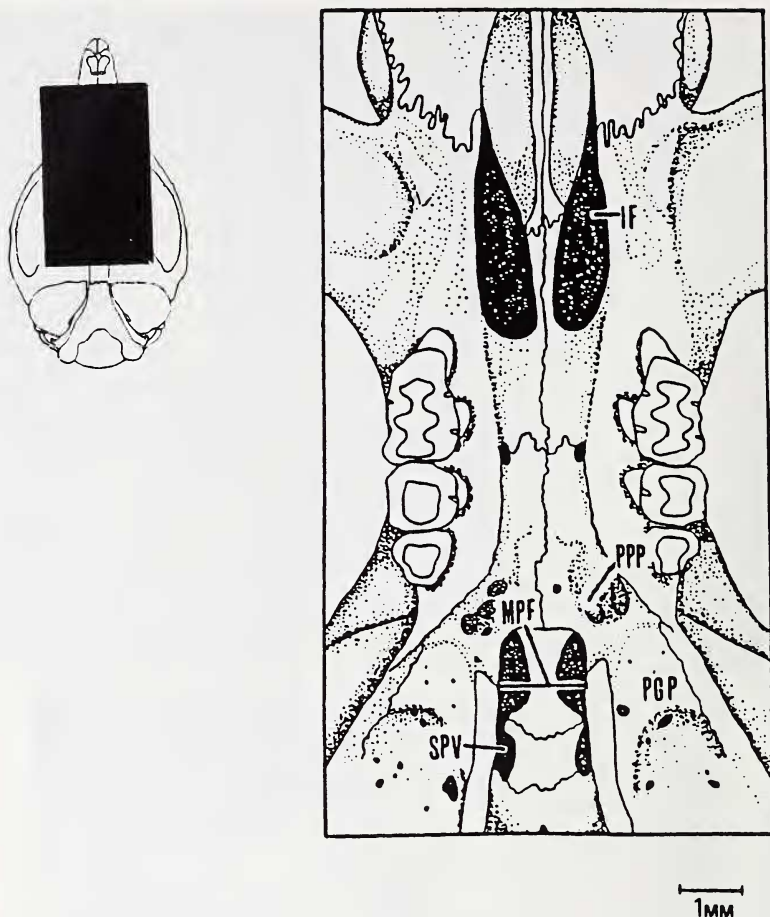


Fig. 6. Diastemal and palatal regions of the skull of *Oligoryzomys stramineus* sp. n. holotype (MN34439). IF, incisive foramen; MPF, mesopterygoid fossa; PPP, posterolateral pit; SPV, sphenopalatine vacuity; PGP, parapterygoid plate.

Type locality: Fazenda Vão dos Bois (13°34'29"S 47°10'57"W, 424 m), Terezina de Goiás, Goiás State, Brazil, 24 km N of Terezina, 15 km SW of Rio Paranã, a tributary of the upper Rio Tocantins, road GO-118, km 275.

Etymology: from *stramineus* (straw colored), referring to its orange pelage.

Distribution: from the Cerrado of Northern Goiás and Northern Minas Gerais states and the Caatinga of Paraíba and Pernambuco states, in Brazil (Fig. 7).

Diagnosis: a large-body-sized *Oligoryzomys* species with dorsal color paler than other species, whitish belly, long incisive foramen, broad zygomatic plate, unique diploid number ($2n = 52$).

Description:

External characteristics: Dorsum with three kinds of hairs: dark guard hairs, banded orange with plumbeous (basal half) overhairs, and soft gray underhairs. The mixture of dark guard hairs and orange overhairs accounts for a brownish-orange overall dorsum color in adult animals. In older animals, the pelage of the posterior part of dorsum is more orange-saturated than the anterior part, with a more homogeneous coloration. In young spe-

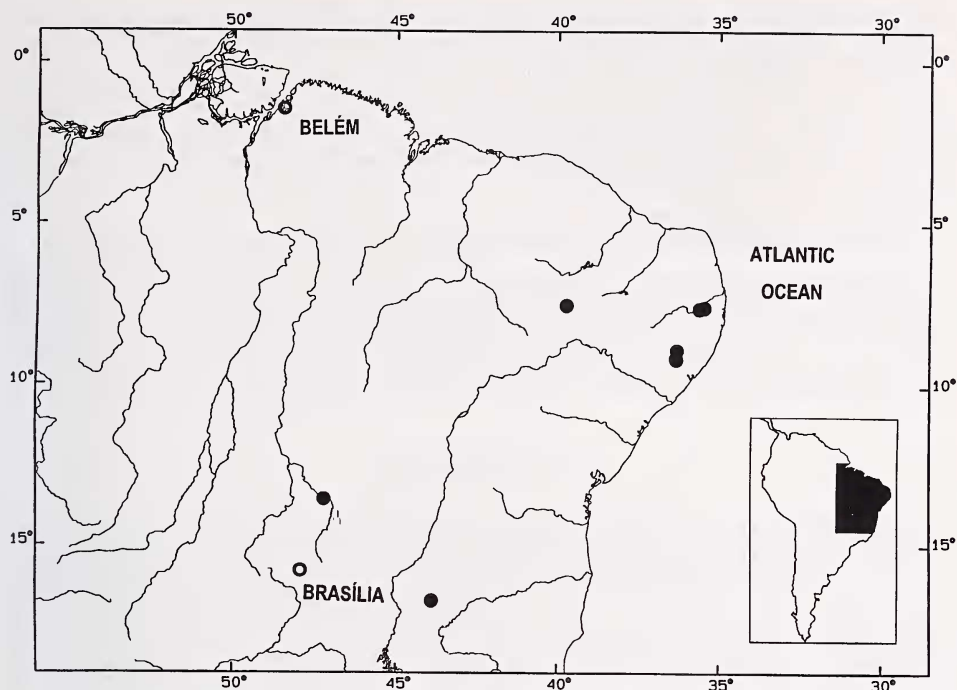


Fig. 7. Localities of occurrence of *Oligoryzomys stramineus* sp. n. (●).

cimens, the overall dorsal color is grayish-yellow and the overall pelage color has a more homogeneous appearance than in adults. Change from young to adult coloration starts laterally, reaches the central middorsum, and later expands to the anterior and posterior dorsum. Head with less orange than dorsum, and cheeks the same color as body sides. Dark ears with few brown orange hairs at inner side. Lateral body color clearly paler, with fewer dark guard hairs. Whitish ventral color with plumbeous basal part, except in chin and ventral side of neck where hairs are white at base. In young specimens, ventral color is beige and whitish. Contrast between ventral and lateral body parts variable among specimens, being more clearly delimited in adult specimens. Tail bicolor, upperparts with wholly gray dark hairs and underparts with lighter creamy hairs. In young specimens, the posterior ventral part or the whole ventral part of tail is gray. Tail with few thin hairs and apparent scales. Feet and limb underparts with white hairs, contrasting with brown orange color of superior parts.

Cranial characteristics: Interorbital region hourglass-shaped without supraorbital ridge. Postorbital ridge absent. Large interparietal, as broad as parietal. Rostrum and interorbital constriction similar in width. Large zygomatic plate without zygomatic spine, and with deep zygomatic notch. Jugal reduced or absent, zygomatic process of squamosal in contact with maxillary. Incisive foramen reaching or extending across plane of first molars (Fig. 6). Mesopterygoid fossa not reaching plane of third molars. Posterolateral pits varying in number, from single and small to multiple pits. Mesopterygoid fossa dorsally perforated by large sphenopalatine vacuities. Width of parapterygoid plate greater than width of mesopterygoid fossa (Fig. 6). Carotid circulation with pattern 2, as described by VOSS and CARLETON (1993), with large opening of stapedial foramen, lack of squamosal alisphenoid groove and sphenofrontal foramen. Medium or large subsquamosal fenestra

and large postglenoid foramen. Alisphenoid strut absent. Molar series parallel. Capsular projection of incisive alveoli prominent. Anteromedian flexus of M1 present but shallow.

External measurements: head and body length $n = 33$, mean = 94.3, sd = 10.2, range = 70–111; tail length $n = 32$, mean = 118.6, sd = 9.2, range = 95–134; hind feet $n = 33$, mean = 25.5, sd = 1.4, range = 23–29; ear length $n = 32$, mean = 16.1, sd = 1.6, range = 12–20. We did not detect sexual dimorphism in external measurements (t test). Cranial measurements are shown in table 1.

Karyotype: $2n = 52/FN = 68-70$.

Comparison with other species: see morphological considerations in discussion.

Comments: CARLETON and MUSSER (1989) considered specimen USNM 528416 as *O. chacoensis*. We disagree for the following reasons: (1) karyotypic data, showing $2n = 52/FN = 70$ (GARDNER, pers. comm.), different from the characteristic karyotype of *O. chacoensis* ($2n = 58/FN = 74$; MYERS and CARLETON 1981); (2) cranial measurements, showing similar size as *O. stramineus* sp. n., and therefore larger than *O. chacoensis*.

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Zusammenfassung

Eine neue *Oligoryzomys*-Art aus Nordwest- und Mittel-Brasilien

Eine neue *Oligoryzomys*-Art aus Mittel- und Nordwest-Brasilien, *Oligoryzomys stramineus* sp. n., wird auf morphologischer Basis, biogeographischer und cytogenetischer Analyse beschrieben. Der Vergleich mit anderen *Oligoryzomys*-Arten zeigt zwei Artengruppen: die eine enthält größere Arten mit weißem Bauch (*O. chacoensis*, *O. nigripes*, *O. delticola* und *O. stramineus* sp. n.) und die andere Gruppe enthält kleinere Arten mit gelbem Bauch (*O. fornesi*, *O. microtis* und *O. flavescens*).

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